Briefing Paper: Problems with the Standard Practice Methodology

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August 5, 2003

Purpose:

This briefing paper has three objectives.

1. ***Provide observations and recommendations regarding how the WG1 dynamic pricing vision statement in CPUC R.02-06-001 should be evaluated.*** Early working group discussions seem to accept by default that the benefit cost methodology set forth in the Standard Practice Manual (SPM) should be used to structure the evaluation of the WG1 dynamic pricing vision statement. Examination of the SPM strongly suggests that the SPM is not appropriate for evaluating the dynamic pricing recommendation.
2. ***Identify some of the shortcomings with the benefit cost methodology set forth in the Standard Practice Manual (SPM).*** There is a broad consensus that SPM makes incorrect and restrictive assumptions that consistently undervalue demand side benefits and overstate costs.
3. ***Propose a project structure and task plan to either (1) repair the SPM or (2) develop alternative acceptable evaluation methodologies for demand-side options***.

The investigation that led to this review was precipitated by the adoption of a policy group vision statement in CPUC proceeding (R.02-06-001) that proposes a new rate policy, which in turn conceptually redefines California's approach to demand response. It was not clear that the SPM could accurately capture either the costs or benefits attributed to this vision statement.

A review found the SPM methodological approach inappropriate for evaluating the dynamic pricing concepts embodied in the WG1 vision statement. The review also found that the SPM methodological shortcomings apply as well to most other conventional demand response programs.

Background

Over the last twenty-five years, planners and regulators in California have attempted to compare and balance investments between demand and supply-side options. The Standard Practice Manual (SPM) documents a methodology and several different benefit/cost ratios or perspectives, developed for this very purpose.

Although technologies underlying many of the demand side options have continued to add capability and decline in cost, SPM results typically produce less than favorable results. This is particularly true for demand side options that include technology implementations that add or increase costs, regardless of improvements in service features. Dynamic tariffs that use applications of advanced metering and communications are often used as an example to illustrate this problem. Approximately 25 years ago, dynamic rate programs were deemed by SPM measures to be only marginally more costly than conventional supply. While the potential benefits were substantial, SPM sensitivity analysis seemed to indicate that the benefit cost threshold could be achieved only if metering costs could be reduced below $100 per residential unit. Today, after 25 years of additional development, advanced metering offers substantially greater functionality and more potential benefit at an average price now well below the $100 threshold. Even though the supply-side cost benchmarks have not added functionality and in some cases have increased in cost, SPM analysis still concludes that dynamic rates may not yet produce favorable benefit cost results.

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[1] This briefing paper was created for the California Energy Commission as part of a project to update the methodology for evaluating demand response programs.

SPM results create a dilemma for the CEC. Are the SPM results driven by technologies that are not yet capable of meeting a reasonable cost-performance standard or is the SPM methodology itself producing incorrect results?

If the SPM results are correct, the CEC must determine the cost performance thresholds for advanced metering, distributed generation and other demand-side technologies and then determine: (1) whether these cost performance objectives are attainable, and (2) how much to invest in research and development to produce a competitive product. If the SPM methodology is producing incorrect results, existing demand-side planning decisions, research priorities and budget allocations are incorrect.

The joint vision statement established by Working Group 1 (WG1) in CPUC proceeding R.02-06-001 is being used to guide the evaluation of innovative and very critical changes in statewide rate policy. Of particular concern is a WG1 proposal to adopt dynamic pricing which requires the implementation of advanced metering, communications and improved utility back office capability. It is essential that the evaluations provide a clear assessment of the costs and benefits. The timeline for this proceeding further requires that the potential strengths and weaknesses of the SPM be resolved immediately.

Not withstanding historical concerns, the WG1 vision statement complicates the evaluation process by recommending dynamic pricing, a demand response initiative structurally different from those the SPM was initially designed to address. In the past, demand response initiatives have been implemented as standalone, clearly defined programs where load impacts are easy to classify and the costs are relatively easy to isolate. In contrast, the joint vision statement established by WG1 takes an evolutionary approach that uses pricing policy to integrate demand response principles into the utility rate structure. Instead of paying customers to participate, customers will be provided with a rate that rewards them for actual demand response performance. With the integrated approach there is a rate but no distinct demand response program. Demand response becomes an indistinguishable part of the customer service package. There are no conventional, consistent or easily classified load impacts and costs don’t necessarily follow traditional demand side conventions. Some of the conceptual differences between the WG1 vision statement and a conventional demand response program are illustrated in Table 1.

A preliminary review concluded that there are conceptual and methodological problems with the SPM, particularly as they apply to the WG1 vision statement, specifically:

1. Conceptually, the SPM is not an appropriate methodology for evaluating policy-oriented, rate-based or many other demand side options.
2. The SPM makes explicit and implicit assumptions and specifies relationships between costs and benefits that do not accurately or fairly characterize demand side options. In almost all instances, the SPM undervalues benefits, overvalues costs and ignores basic principles of welfare economics.

Table 1. Comparing the WG1 Vision Statement with a Conventional Demand Response Program

Attributes	WG1 OIR Vision Statement	Conventional Demand Side Option
Incentives	Performance Oriented –rate provides incentives based on actual usage.	Participation / Ownership Oriented – Incentives reward customers for participating or for acquiring a featured appliance regardless of any change in usage pattern.
Technology	Provides a means for the customer to adapt to the rate.	Provides the focus for the program – e.g. load control..
Customer Control	• Customers choose the technology option appropriate for their situation • Customers choose the control strategies consistent with their preferences.	• The utility chooses the technology options. • The utility determines which control strategies to offer
Metering	A critical component, necessary to support the measurement underlying the performance based incentives.	Limited capability may be necessary only to support curtailable/interruptible and TOU rates.
Communications	Necessary to provide a link to market changes in price / reliability.	May be necessary, to provide control signals which act as a proxy for price / reliability
Load Impacts	Customers are incented to respond with any one or more of the following strategies. • Shift load from peak to off-peak periods while holding total usage constant • Curtail usage in peak periods and reduce overall usage • Reduce overall usage in all periods. • Maintain peak usage, while increasing off-peak and overall usage.	Customers are typically assumed to respond to only one of the following strategies: • Curtail or reduce peak usage • Reduce overall usage

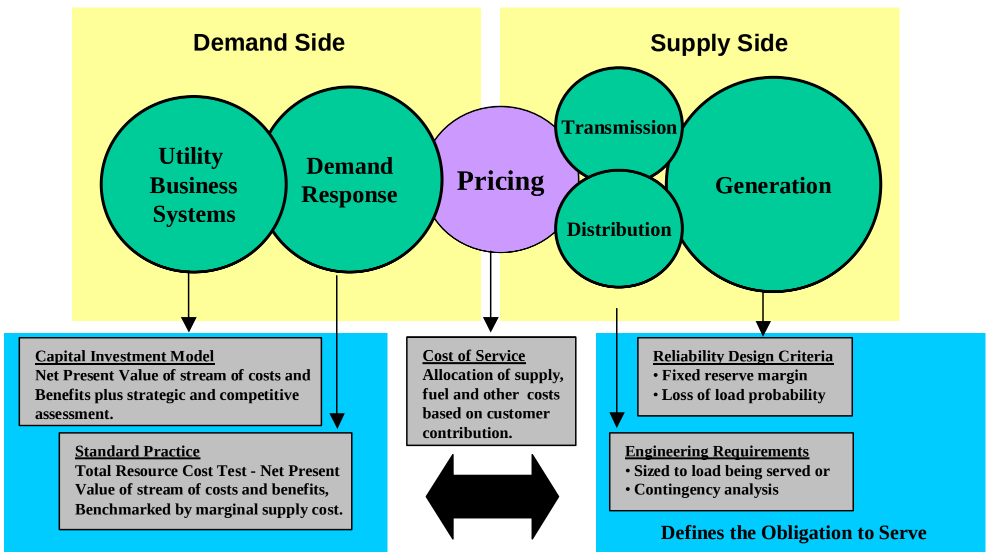
Conceptual Limitation – Applying SPM to Dynamic Pricing

Exhibit 1 graphically depicts how demand response fits into and relates to the traditional utility system cost centers. What is important to note is that each cost center (Pricing is not a cost center) has its own commonly accepted evaluation methodology.

On the supply side, generation requirements are derived from reliability design criteria based on loss of load probabilities or fixed reserve margin requirements. The SPM generally accepts whatever level of demand is assumed in the generation planning process, without regard to whether price elasticity or quality of service have been considered. Transmission and distribution are linked through engineering requirements to generation on one side and customer load on the other. On the demand side, capital investment models are used to guide utility commitments in computer information and communication technologies, metering, billing and other business systems. All of the investment models, like the SPM, translate a stream of costs and benefits into results expressed as a net present value. Unlike the SPM, most other models also include hard to quantify variables like risk, uncertainty and strategic value.

Pricing, unlike the other components in Exhibit 1, is not an investment center. Ideally, pricing is a process to translate utility costs into rates, where rates use cost of service principles to allocate the aggregate supply and demand side costs, or revenue requirement, equitably among utility customers.

Exhibit 1. Utility Investment Centers and Evaluation Criteria



Because each cost center is characterized with its own accepted evaluation or planning criteria, how an investment is evaluated is critically dependent upon how it is defined.

How dynamic pricing is defined is particularly critical and relevant to how the WG1 vision statement will be evaluated. Until recently, dynamic pricing has been assumed to be a demand response option. That assumption is not correct.

The WG1 vision statement proposes a basic change in rate policy, where dynamic tariffs become the default standard for all customers. While other tariff options would be provided on a voluntary basis, each alternative is supposed to include an 'insurance premium', or adjustment, to compensate for the lack of a dynamic link to market price. Because dynamic tariffs are linked to the market, they can be adjusted in a timely fashion to provide more accurate reflections of price or system reliability needs. The link to the market encourages customer price response, which reduces reserve margin and other costly contingency needs. Non-dynamic tariffs cannot provide a timely reflection of market conditions; therefore, they have to include some form of insurance premium to better reflect the potential increased contingency costs.

As defined, the WG1 vision statement, in its most elementary form, is nothing more than a uniform pricing proposal that advocates a more accurate application of existing cost of service principles.

Cost of service principles represent a standing, long accepted regulatory policy that is supposed to guide California utility regulation. While the actual allocation formulas underlying the cost of service process may be subject to debate, cost of service principles are not classifiable as a demand response option. By definition then, cost of service is not subject to evaluation by SPM, capital investment or any other investment model.

This definitional perspective has substantial implications for the WG1 vision, specifically:

- Dynamic pricing is another way to more accurately address cost of service.

- Neither metering nor dynamic pricing are demand side measures subject to or appropriate for evaluation by the SPM.
- Metering and communication investments necessary to support dynamic pricing are a cost of service. These investments should be evaluated under a capital investment model, which should also account for risk, uncertainty and utility strategic value. A risk assessment should consider metering and communication in much the same way that loss of load probabilities are used to calibrate generation reserves, where the objective is to match resource acquisition with value of service not provided.
- Results of the capital investment evaluation should be combined with a public policy evaluation that considers how more capable metering and communication can impact:
  - the ability to respond to system emergencies,
  - the development of rates that promote improved fairness and equity,
  - access to information to improve customer education and
  - improved utility and regulatory efficiencies and reduced costs through the integration of demand management and efficiency programs under a common, pay-for-performance incentive structure. ,

Under the WG1 vision statement, dynamic pricing at best creates a 'virtual' demand side option, where basic price signals incent customer response. Unlike conventional demand response programs, dynamic pricing is not being proposed as an adjunct to an existing customer rate, it is not being targeted to a select group of customers, nor is it proposed as an incentive to encourage a specific change in load or usage. Instead, dynamic pricing has been proposed as a tariff designed to more accurately link customer usage decisions with cost responsibility. More accurate pricing will encourage some customers to reduce peak load, however, other customers may derive more value by increasing load and usage to take advantage of reduced off-peak prices. In other words, dynamic pricing should encourage all customers to pursue more efficient and higher value energy usage patterns. Customer response to more accurate pricing can be considered a demand response. However, dynamic pricing is not, in the conventional sense, a demand response program.

While dynamic pricing may not be a demand response program, there are at least two substantial costs associated with implementation: (1) customer investments in technologies to facilitate short-term adaptation to the rate/price structure, and (2) utility investment in metering, communication and related systems. Economic theory assumes that customers will not invest in anything unless it produces a value of service or net benefit in excess of their cost. Therefore, cost effectiveness with regard to customer investments should be self-regulating and not at issue. Customer investments will only proceed if they are by definition – cost effective.

Any incremental investment by the utility to support dynamic pricing should be considered a cost of service, which should be subject to evaluation and review. The evaluation and review should combine capital investment and public policy issues to determine:

(1) what constitutes an appropriate utility investment to support more accurate cost of service allocations and

(2) do improvements in operational flexibility, access to information, customer service, and other benefits justify investment.

Existing cost of service allocations create a Catch 22 dilemma. Current rate design and cost allocation processes delink customer usage and cost causation, which in turn contributes to equity, fairness, and system reliability problems. The failure to link customer usage and cost causation creates the need for a myriad of incompatible conservation and demand response programs, each with separate education, technology, incentive and evaluation elements.

The decision to not link customer usage and cost causation also directly incents utilities to invest only in equipment, systems and procedures that support the status quo. While metering and information technologies are available to more accurately link customer usage and cost, existing investments create a substantial barrier to change. New policies or processes can't be implemented until utilities change out the old metering equipment; however, utilities won't change the equipment until they fully recover current investments. At the same time, utilities continue to expand economic barriers by purchasing and replacing existing meters with functionally similar equipment.

Capital investment models are appropriate for evaluating investments in alternative metering and related systems. However, the issues inherent in the WG1 vision statement also require any economic analysis to be tempered by public policy concerns that consider equity, fairness, and long-run impacts on customer service. In other words, results from a capital investment evaluation can only provide one of many quantitative and qualitative elements that must be considered in the evaluation decision.

Other Limitations with SPM

- <u>The SPM incorrectly uses the existing level of service received by customers as the benchmark, or optimum service level, against which all other options are judged.</u>

  Each of the SPM measures compute incremental changes in costs and benefits that use existing customer costs or system investment as the baseline value. However, by using the <u>current service</u> as the starting point, the SPM implicitly assumes that the current service package (cost, quality, reliability and other services) already provides customers with an optimum level of service. For this assumption to be correct, customer's should not be willing to invest funds to improve or purchase additional services or to consider incentives to forgo any of their existing service. We know that this assumption is not correct.

  Using the existing service as the benchmark creates a particular bias against any hardware or technology oriented demand-side option that requires an investment and results in either an increase in usage or net increase in the customer costs, regardless of the value received by the customer. For example, on-site backup or distributed generation are generally expensive investments used to improve customer service reliability. These investments will generally fail the Participant and Total Resource Cost test because the increase in costs is not offset by a comparable decrease in the customer bill – measured using current rates. The SPM does not provide a reasonable way to assess the change in value received.

- <u>SPM measures improperly characterize and value demand-side options using a utility rather than a customer perspective.</u>

  Valuing benefits as customer bill savings based on program induced changes to utility operating and avoided supply costs (generation, T&D, etc.) further emphasizes the view that the 'current utility service' is already optimal. More significantly, this approach takes a utility centric perspective, where costs flow from the utility to the customer and for savings to occur, customers must reduce their load or usage, which may or may not reduce the utility cost.

  This utility centric approach immediately excludes from consideration demand-side options that may improve customer service but not impact existing or planned utility supply. This approach also assigns no value, from the customer perspective, to potential system design options and investments that the utility is not planning to make. *In other words, you can't count as a deferred cost, something you are not planning to incur.*

  Most significantly, by taking a utility rather than customer perspective, the SPM typically assigns much higher value to generation than to transmission or distribution. There are two major problems with this approach.

1. From the customer perspective, most power quality, disturbance and reliability problems are due to random, uncontrollable events in the distribution system. Therefore, at least from the customer perspective, distribution improvements have a much higher value than generation improvements, and

2. The SPM provides an unequal and asymmetrical valuation of utility and customer costs and benefits. Utility supply is valued at replacement value, most often using a peaker proxy, which reflects utility out-of-pocket costs. Customer service value is also based on utility supply costs rather than customer out-of-pocket costs.

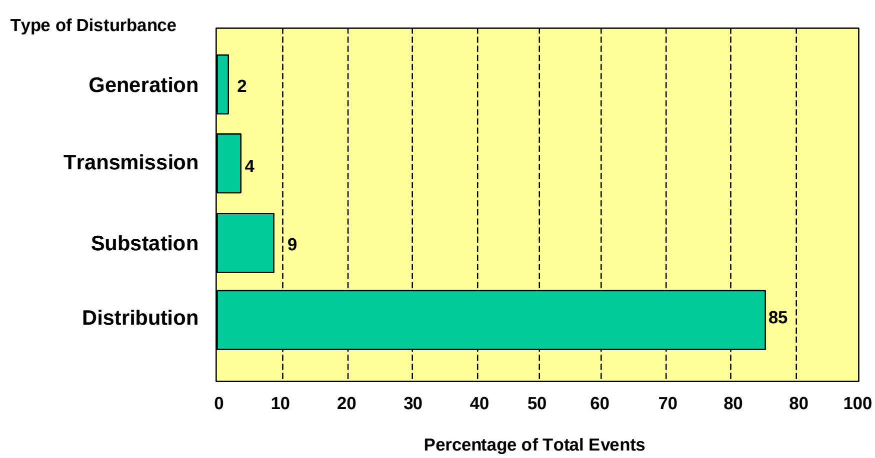
Utility systems are franchised to provide customer services. This is emphasized in the obligation to serve doctrine, which forms the basis for all current supply side engineering and planning criteria. "The industry assumption has been that consumers want service of the highest reliability that is technically feasible".[2] Consequently, it makes sense to consider and value demand-side benefits and costs, from the customer not the utility perspective.

Figure 2 and Table 2 provide examples that map utility system disturbances (reliability) from the customer not the utility perspective. Contrary to the focus in most evaluation proceedings, Figure 2 shows that from a customer perspective, a vast majority of the disturbances occur in the distribution system from random weather and accident related incidents – not generation. Table 2 translates these disturbances into the characteristics seen by the customer. In general, most generation problems provide some advance notice and with the exception of the 2000-2001 market, result in planned curtailments, not full outages. In contrast, distribution disturbances generally provide little notice and almost always result in a full loss of service.

What is not immediately obvious, is that conventional additions or expansion of the generation system and improvements or even redesign of the transmission / distribution systems, have little impact on the quality of service viewed from the customer perspective. While distribution design changes can provide contingent or secondary service paths, this approach is expensive and generally suitable only for the very largest commercial and industrial customers. Because of the nature of most system disturbances, the most effective options will focus on the customer site.

Collectively, the utility perspective and valuation problems systematically undervalue demand-side options like power conditioning and distributed generation.

Figure 2. Low Magnitude, Short Duration and Bulk Power Outages by Generic Subsystem [3]



[2] Value-based Utility Planning: Scoping Study, EPRI EM-4389, Final Report, January 1986, p. 3-11.

[3] Ibid, pp. 2-9.

Table 2. Mapping of Utility System Disturbances to Customer Impacts [4]

System Component	Warning Time	Disturbance	Shortage Management Strategy	Immediate Customer Impact	
Generation	None	•Unplanned Loss of Major Facility	1. Curtail Loads 2. Rotating Outages	•Partial Outage •Full Outage	•Sudden unplanned loss of loads assigned on under frequency relays •Unlikely
	Some	•Unplanned Outage •Extreme Weather	1. Purchase Power 2. Interrupt Loads 3. Curtail Loads 4. Rotating Outages	•None •Partial Outage •Partial Outage •Full Outage	•Increase in cost of service •Orderly shutdown after warning •Unlikely •Unlikely
	Substantial	•Unplanned Outage •Delayed start of facility	1. Purchase Power 2. Voluntary Appeal 3. Interrupt Loads 4. Curtail Loads 5. Rotating Outages	•None •Partial Outage •Partial Outage •Partial Outage •Full Outage	•Increase in cost of service •Orderly shutdown of low value loads •Unlikely •Unlikely •Unlikely
Transmission And Distribution	None	•Loss of Intertie •Weather Damage	1. Reroute Service	Full Outage	Unplanned loss of all load
	Some	•Extreme Weather buildup	1. Reroute Service	Full Outage	Unplanned loss of all load
	Substantial	•Major Maintenance •Forecast Severe Weather Damage	1. Warning – Voluntary Appeal 2. Reroute Service	Full Outage	Unplanned loss of all load

- The SPM emphasizes narrowly defined programs with distinct load shape and cost characteristics.

  The SPM explicitly excludes a number of demand-side options that provide multiple fuel, complex load shape changes, information, or system integration capabilities. These options are excluded primarily because their impacts are difficult to quantify or because their load impacts are not consistent with specific SPM program definitions. The SPM classifies and assigns very specific load impacts to each type of demand side management program.

  For example, although advanced metering can provide customers with access to valuable usage information that supports better investment and operating decisions, the SPM assigns no value to the information capability because of the difficultly in determining how load might be impacted. As a result, any demand-side initiative that requires advanced metering will automatically be handicapped in an SPM evaluation. Metering and related systems to support new pricing options will be counted as a cost, however, any information or educational value derived from metered information would be assigned no value.

  The inability to handle broad-based pricing options, that integrate what traditionally have been numerous independent programs, artificially limits the development of more efficient, productive demand side options. For example, market-based price signals through dynamic tariffs can provide a more efficient, consistent way to encourage the same load impacts now offered through separate load control and curtailable/interruptible programs. The same dynamic tariff can also provide the incentive structure to support appliance efficiency, solar, building automation and other demand side options. However, dynamic tariffs are not necessarily suitable for SPM evaluation, because their load impacts do not fit the SPM definitions.

[4] Ibid, pp. 2-6.

- SPM measures do not adequately account for or differentiate between the scope and magnitude of competing demand-side options.

  All SPM measures are expressed either in terms of Net Present Value (NPV) or as lifecycle monetary impacts (cost or benefit) per unit of energy. While these measures allow supply and demand-side options to be compared on a common unit basis – these measures do not adequately differentiate between : (1) the magnitude of total impacts produced by each option, (2) the expected persistence / life cycle of the impacts, or (3) the magnitude of the aggregate investment requirement.

  For example, a load control program with 10 customers that produces 10 kW of peak load impacts for one year could be judged on a NPV basis or unit cost/benefit basis, to be equivalent to a 1000 customer, 1 mW program that lasts for 20 years.

  The inability of SPM measures to differentiate between the scope and magnitude of demand-side options raises substantial concern regarding their basic purpose and usefulness. What value does a comparison of demand-side options provide if it does not also address overall resource value?

- The SPM does not properly define nor consistently account for demand-side benefits.

  For several of the SPM measures, benefits are defined only as a reduction in the customer bill plus other monetary incentives received. There are substantial problems with this restricted definition, specifically:

  - No value is assigned to improvements in service quality or in other qualitative aspects of service. The SPM assumes that all benefits from electric service are monetary and quantified in the monthly bill. Customer costs are limited to 'out of pocket' quantifiable costs – changes in either the quality or level of service are not valued. These assumptions are incorrect. Lighting is often used to illustrate this problem. For relative low cost, customers could respond to a demand management request by turning off all of their lighting load. This response reduces demand and saves energy and under SPM evaluation will probably produce positive benefit cost results. However, turning off all lights creates obvious productivity and safety problems that are difficult if not impossible to value and capture within the SPM.

  - All bill impacts are defined as the change in usage multiplied by the actual retail rates that would have been charged under the customer's existing rate. With this approach, costs that are avoided through a demand response or costs that are delayed due to decreased fuel or other recoverable revenues are not considered.

  - Demand-side impacts are computed only for program participants, even though peak costs, revenue requirements, or outages will be reduced for the non-participants as well.

  - The SPM implicitly assumes that the utility revenue requirement is fixed and that incentives are 'paid out' to participants. As a result, shifts in revenue to one group of customers in the form of incentives, have to be made up by increased charges to non-participants. The SPM does not explicitly address incentives that allow participating customers to 'avoid costs' and reduce the utility revenue requirement.

- The SPM does not emphasize the need to look at alternatives to utility owned and financed investments. Customer investments, financed with avoided cost and outsourcing are not explicitly considered.

- The SPM does not address risk, uncertainty, environmental, and almost all other qualitative measures of cost or value.

There have been numerous reviews of the strengths and weaknesses of the SPM since it was first introduced. Table 3, highlights the major issues identified in formal papers prepared by two utility consulting firms.

Table 3. Other Viewpoints – Problems with the SPM Methodology

Author	Concerns
Christensen Associates [5]	1. Failure to account for participants increase in total value. 2. Failure to account in full for the impact of electricity price changes. 3. Failure to account for different degrees of energy efficiency market imperfections.
Charles Rivers Associates [6]	1. SPM is not well equipped to accurately measure the benefits of dynamic pricing to participating customers. 2. The SPM does not explicitly account for the wide variety of operational benefits of advanced metering systems that are a pre-requisite for enabling dynamic pricing. 3. The SPM tests often ignore the complexity of valuing capacity benefits over time. 4. The SPM understates the benefits of demand-side programs by not valuing the impact of demand response on wholesale markets.

[5] Three Biases in Cost-Efficiency Tests of Utility Energy Efficiency Programs, Steven Braithwait, Douglas Caves, The Energy Journal, Vol. 15, No. 1, 1994

[6] Updating the California Standard Practice Manual (SPM), private paper, Ahmad Faruqui, Stephen George, June 2003.